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**ELECTRICAL CHARACTERISTICS:**

The following electrical characteristics shall be inspected on 100 percent of units procured. The test shall be performed with 30 microwatts max drive and 25 plus or minus 1 degree centigrade unless otherwise specified.

1. **Frequency:**
   - 3.040000 Megacycles plus or minus .003 percent, calibrated in a standard 330 Q meter at 80 microfarads load capacitance.

2. **Series Resistance:**
   - 30 ohms maximum from zero degrees centigrade to 85 degrees centigrade; 50 ohms maximum from minus 20 degrees centigrade to zero degrees centigrade.

3. **Nominal Capacitance:**
   - $C_1 = \pm 0.024$ uf plus or minus 5% minus 10 uf.

4. **Shunt Capacitance:**
   - $C_2 = 5$ picofarads plus or minus 1 picofarad.

5. **Temperature Characteristics:**
   - Turn-over temperature shall be between 63 degrees centigrade and 67 degrees centigrade. Maximum deviation shall be less than 15 parts per million over the temp range of -10°C to +70°C.

**MECHANICAL REQUIREMENTS:**

1. **Marking:**
   - Sample per MIL-STD-105, level I, AQL of 4 percent.
   - Packaging and packing shall be marked in accordance with MIL-STD-129 both internally and externally with the manufacturer's name, NASA drawing number and revision letter, serial number, date of manufacture, nominal frequency and turn-over temperature.

2. **Dimensions:**
   - In accordance with outline. 100 percent of units procured shall be inspected for this requirement.

3. **Lead Material:**
   - Lead material shall be iron-nickel-cobalt alloy (C46500) in accordance with PS 1015402. A certificate of compliance with this requirement shall accompany each shipment.

4. **Crystal Mounting:**
   - The crystal mounting shall be ruggedized to enable unit to meet the requirements specified herein.

**SPECIFICATION CONTROL DRAWING**

**CRYSTAL UNIT, QUARTZ**

**MANUFACTURER:**

INSTRUMENTATION LAB
CAMBRIDGE, Mass.

**CONTRACT:**

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

**NOTE:**

Revised per torr 04/06/77.
3. DESIGN REQUIREMENTS:

A. SHELF LIFE: UNITS SHALL BE CAPABLE OF OPERATING WITHIN THE REQUIREMENTS SPECIFIED HEREIN AFTER THE FIRST YEAR OF UNPACKAGED STORAGE UNDER THE FOLLOWING CONDITIONS: RELATIVE HUMIDITY UP TO 95 PERCENT, TEMPERATURES AS LOW AS MINUS 18 DEGREES CENTIGRADE OR AS HIGH AS PLUS 52 DEGREES CENTIGRADE, AND AT ALTITUDES AS HIGH AS 60,000 FEET. IT SHALL BE ASSUMED THAT THE UNITS WILL BE EXPOSED TO AMBIENT ATMOSPHERE DURING THE ONE YEAR PERIOD.

B. PACKAGED STORAGE: UNITS SHALL BE CAPABLE OF OPERATING WITHIN THE REQUIREMENTS SPECIFIED HEREIN AFTER THREE YEARS OF DEAD STORAGE WHEN PACKAGED FOR OVERSEAS SHIPMENT IN ACCORDANCE WITH SPECIFICATION JAN-P-100-1. ENVIRONMENTAL CONDITIONS FOR PACKAGED STORAGE SHALL BE AS INDICATED FOR ALL NON-OPERATING CONDITIONS SPECIFIED ABOVE. THE STORAGE TEMPERATURE MAY BE AS HIGH AS PLUS 71 DEGREES CENTIGRADE OR AS LOW AS MINUS 40 DEGREES CENTIGRADE, THERE MAY BE VIBRATORY ACCELERATION FOR PERIODS OF 25 HOURS PER SECOND AND THERE MAY BE OCCASIONAL SHOCKS UP TO 100.60 DEGREES CENTIGRADE 50 MICROWATTS CRYSTAL DRIVE.  

C. LEAD TENSION: LEADS SHALL BE CAPABLE OF WITHSTANDING AN AXIAL PULL OF 6 POUNDS MINIMUM. NO MECHANICAL DAMAGE OR LACK OF PERFORMANCE SHALL BE EVIDENCED AS A RESULT OF THIS TEST, SIMILAR TO THAT OBTAINED WITH A BARRY TYPE SHOCK MACHINE.  

D. SPURIOUS MODES: ALL SPURIOUS MODES SHALL BE AT LEAST 3.5 DECIBELS BELOW THE BODY RESONANCE. PERMANENT FREQUENCY CHANGE AFTER VIBRATION SHALL BE NO GREATER THAN PLUS OR MINUS 1 PART PER 10^6. A RESONANCE SEARCH SHALL BE MADE THROUGHOUT THE FREQUENCY RANGE, SIMILAR TO THAT OBTAINED WITH A BARRY TYPE SHOCK MACHINE, AND A 15 MINUTE FATIGUE VIBRATION TEST SHALL BE PERFORMED AT EACH MAJOR RESONANCE. PERMANENT FREQUENCY CHANGE AFTER VIBRATION SHALL BE NO GREATER THAN PLUS OR MINUS 1 PART PER 10^6. 

E. CRYSTAL ELEMENT: QUARTZ, "AT" CUT, GOLD OR ALUMINUM PLATED. A CERTIFICATE OF COMPLIANCE WITH THIS REQUIREMENT SHALL ACCOMPANY EACH SHIPMENT. 

F. ENVIRONMENTAL REQUIREMENTS: UNITS SHALL BE CAPABLE OF WITHSTANDING THE FOLLOWING ENVIRONMENTAL TESTS. MECHANICAL TESTS (VIBRATION, SHOCK AND ACCELERATION) SHALL BE CONDUCTED WITH THE UNIT MOUNTED BY MEANS OF AN APPROPRIATE FIXTURE WITH THE BODY RESTRAINED FROM MOVEMENT. 

(1) VIBRATION: WHILE OPERATING FROM 15 TO 31 CYCLES PER SECOND AT 0.2 INCH DOUBLE AMPLITUDE: FROM 31 TO 2,000 CYCLES PER SECOND AT PLUS OR MINUS 100.60 DEGREES CENTIGRADE 50 MICROWATTS CRYSTAL DRIVE. A 15 MINUTE FATIGUE VIBRATION TEST SHALL BE PERFORMED AT EACH MAJOR RESONANCE. PERMANENT FREQUENCY CHANGE AFTER VIBRATION SHALL BE NO GREATER THAN PLUS OR MINUS 1 PART PER 10^6. 

(2) MECHANICAL SHOCK: WHILE OPERATING, 50G FOR 11 MILLI-SECONDS PLUS OR MINUS ONE (1) MILLI-SECOND DURATION SIMILAR TO THAT OBTAINED WITH A BARRY TYPE SHOCK MACHINE. PER-MANENT FREQUENCY CHANGE AFTER SHOCK SHALL BE NO GREATER THAN PLUS OR MINUS 2 PARTS PER 10^6. 

(3) ACCELERATION: WHILE OPERATING AND NON-OPERATING, PLUS OR MINUS 20G IN ANY DIRECTION FOR 5 MINUTES. PER-MANENT FREQUENCY CHANGE AFTER ACCELERATION SHALL BE NO GREATER THAN 1 PART PER 10^6. 

G. AGING: PLUS 1 PART PER 10^6 PER WEEK MAXIMUM AT PLUS 60 DEGREES CENTIGRADE 50 MICROWATTS CRYSTAL DRIVE.  

(1) TEMPERATURE SHOCK: MINUS 40 DEGREES CENTIGRADE FOR 30 MINUTES AND PLUS 85 DEGREES CENTIGRADE FOR 30 MINUTES. THE INTERVAL CHANGING FROM ONE TEMPERATURE EXTREME TO THE OTHER SHALL NOT EXCEED 15 SECONDS. PERMANENT FREQUENCY CHANGE AFTER TEMPERATURE SHOCK SHALL BE NO GREATER THAN 1 PART PER 10^6. 

H. RELATIVE HUMIDITY: UNITS SHALL BE CAPABLE OF WITHSTANDING A RELATIVE HUMIDITY OF UP TO 95 PERCENT UNDER THE FOLLOWING CONDITIONS: RELATIVE HUMIDITY UP TO 95 PERCENT, TEMPERATURES AS LOW AS MINUS 18 DEGREES CENTIGRADE OR AS HIGH AS PLUS 85 DEGREES CENTIGRADE. 

I. VIBRATION SPECTRUM: UNITS SHALL BE CAPABLE OF WITHSTANDING VIBRATION SPECTRUM SIMILAR TO THAT OBTAINED WITH A BARRY TYPE SHOCK MACHINE. 


K. TIGHTENING SPECIFICATION: UNITS SHALL BE CAPABLE OF WITHSTANDING TIGHTENING SPECIFICATION SIMILAR TO THAT OBTAINED WITH A BARRY TYPE SHOCK MACHINE.